the present production of chinook salmon in Clear Creek. Steelhead populations would similarly benefit.

Restoring the Clear Creek chinook salmon and steelhead populations has been the focus of fishery management efforts in the upper Sacramento River drainage below Shasta Dam for most of the Twentieth Century. Interest and concern regarding the status of salmon and steelhead in this stream began shortly after the 1903 construction of the McCormick Dam, located 6 miles upstream of the Sacramento River. Early restoration efforts attempted to provide suitable adult fish passage at McCormick Dam, but as watershed and instream habitats continued to decline, the need for additional habitat restoration efforts increased. The cumulative effects of water export, gold mining, gravel extraction, timber harvest, road building, and the construction of Whiskeytown Dam have contributed to the decline of the Clear Creek anadromous fishery. Only in recent years has there been a recognition of the complexity of the problem and a multiagency cooperative effort to seek corrective actions designed to restore habitat and fish passage in Clear Creek. Local environmental groups and individuals have also been seeking solutions to the problems limiting Clear Creek's fishery potential.

The California Department of Fish and Game (DFG) manages Clear Creek for fall- and late-fall-run chinook salmon and steelhead trout. The stream is uniquely suited for intensive management because of its ability to provide cool temperatures in the upper reach and adequate flows in fall. The stream below McCormick Dam is most suitable for fall- and late-fall-run chinook salmon spawning, but unsuitable for oversummering spring-run chinook salmon or for year-round rearing of steelhead. Conditions above the dam are suitable for steelhead and spring-run chinook salmon.

McCormick Dam impairs the up- and downstream passage of juvenile and adult anadromous fish. Removal of the dam would improve passage and survival of chinook salmon and steelhead and improve the transport of natural sediments from the stream reach above the dam to the lower reach.

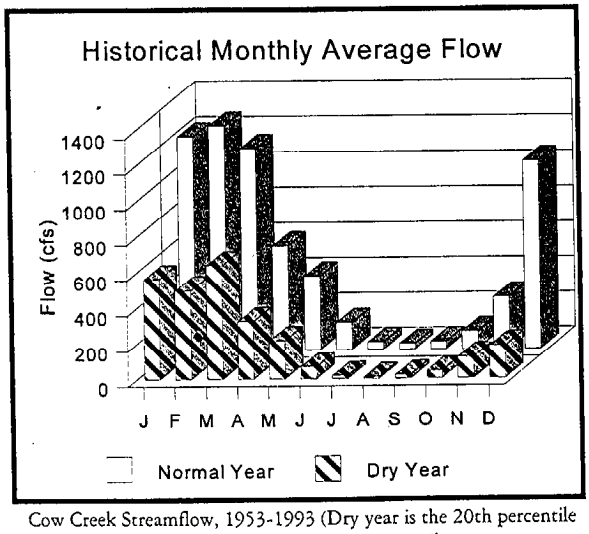
An important component of the Clear Creek Restoration Program is the improvement of fish passage at McCormick-Saeltzer Dam. The U.S. Bureau of Reclamation and the Townsend Flat Water Ditch Company are negotiating the removal of Saeltzer Dam and the transfer of water rights to nearby location.

Cow Creek Ecological Management Unit

Cow Creek flows through the southwestern foothills of the Cascade Range and enters the Sacramento River 4 miles east of the town of Anderson in Shasta County. Cow Creek encompasses five major tributaries: Little (North) Cow, Oak Run, Clover, Old Cow, and South Cow creeks. The drainage area is approximately 425 square miles, and the average discharge is 501,400 acre-feet per year.

Cow Creek has a natural flow pattern of high winter and low summer-fall flows, typical of many Sacramento Valley streams that originate from foothills rather than from the Cascade or Sierra crests. Near its mouth (where the gaging station is located), the stream is nearly dry during the summer and fall months of dry years. USGS surface water records show the mean August flow of 35 cfs, September at 45 cfs, and October at 131 cfs with a maximum August flow of 115 cfs and a minimum of 1 cfs.

In wetter years, flows in winter months average 2,600 to 6,000 cfs. In winter months of dry years, average monthly flows peak at 500 to 650 cfs. In the driest years, winter monthly average flows reach only 80 to 120 cfs. Small agricultural diversions contribute to lower flows in summer and fall. A Pacific Gas and Electric Company (PG&E) hydropower project

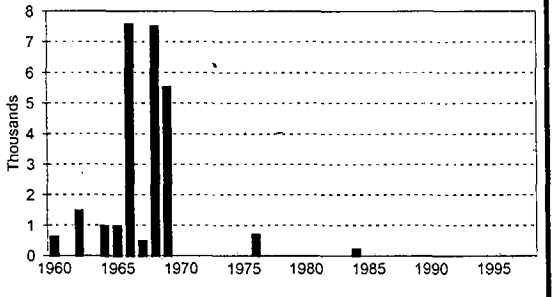


Cow Creek Streamflow, 1953-1993 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

diversion reduces flow on a 10-mile section of the South Fork.

In the past, Cow Creek has supported eight small gravel mining operations. The lower 10 miles of channel is approximately 50% exposed bedrock. Where bedload is deposited, it is generally only a thin veneer. Instream mining was eliminated with the passage of a Shasta County gravel mining ordinance. There has been no instream gravel mining in Cow Creek for at least 12 years. Because of the limited availability of gravel, the bedload transport rate was estimated to be 19,000 tons per year.

Fall-run and late-fall-run chinook salmon spawn in the creek on the valley floor and in all five tributaries. Adult steelhead trout have been observed in South Cow, Old Cow, and North Cow Creeks. Previous management plans have estimated the potential of fall-run salmon in Cow Creek at 5,000 spawners; however, fall-run chinook salmon populations have been as high as 7,600. The average run size from 1953 to 1969 was 2,800 salmon. In recent drought years, there have been too few salmon in Cow Creek to make population estimates. No major diversions exist in the fall-run spawning reach, and the average monthly flow from October through December has actually increased since 1969. The decline in the Cow Creek fall-run salmon population coincides with salmon population declines throughout the Sacramento River basin. There are no estimates for late-fall-run chinook in Cow Creek.



Cow Creek Fall-run Chinook Salmon Returns, 1960-1999 (CDFG 1999).

In 1992, DFG conducted stream surveys of four of the five Cow Creek tributaries. Emphasis was placed on evaluating habitat for spring-run chinook salmon and steelhead trout holding, spawning, and rearing. The survey results concluded that Cow Creek is not suitable for spring-run chinook salmon because of warm summer water temperatures and lack of large holding pools. Steelhead, however, could survive if provided access to the tributaries above the valley floor. North Cow, Clover, and Old Cow Creeks have natural bedrock falls that are either complete or partial barriers to anadromous fish.

Land use activities in the Cow Creek drainage include agriculture, timber harvest, livestock grazing, and hydropower production. Loss of habitat and water diversions are largely the result of activities associated with livestock production. The only laddered dams and screened diversions are part of hydropower facilities. Agricultural diversions are unscreened, ditches are unlined and poorly maintained, and grazing is destroying some of the riparian corridor and causing excessive erosion.

Population growth in the towns of Palo Cedro, Bella Vista, Oak Run, and Millville is resulting in increased demand for domestic water and is affecting riparian habitat in the Cow Creek watershed. Measures are required to protect the existing habitat from further damage associated with gravel extractions, water diversions, creek-side development, and livestock grazing. Cow Creek presents a unique opportunity to maintain and preserve fall- and late-fall-run salmon and steelhead habitat while nearby development increases.

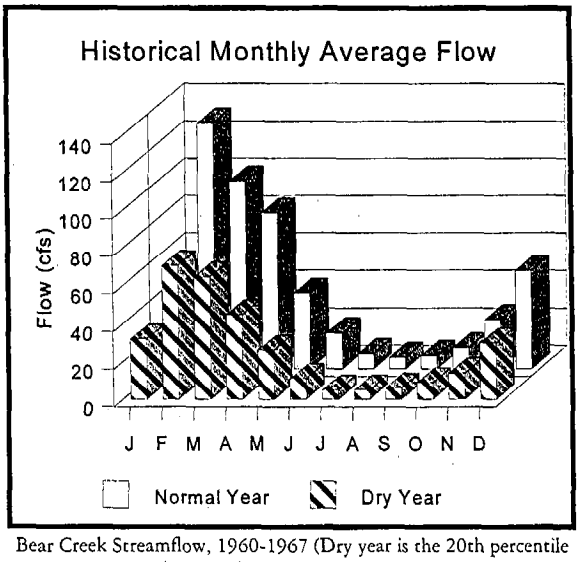
Bear Creek Ecological Management Unit

Bear Creek is a small, eastside tributary entering the Sacramento River 5 miles below Anderson. The stream has low streamflow in spring through fall months of most years and flows year round at the Highway 44 bridge in dry years. All steelhead habitat is above this bridge. During spring and summer, the limited natural streamflow is further reduced by irrigation diversions in the lower reaches, where the stream enters the valley floor. Adequate streamflows in fall and spring are prerequisites for anadromous fish migration and reproduction.

The limited runoff in this small stream makes it difficult to meet the limited agricultural water demands and instream flow needs of anadromous fish simultaneously, especially in below-normal water years. During above normal water years, there is a reduced risk to juvenile salmon and steelhead during the spring diversion season, because irrigation water

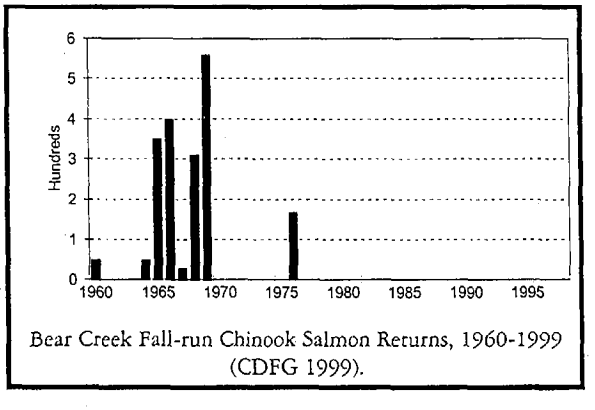
demands are reduced and the diversion rates are relatively small compared to the total streamflow.

Bear Creek has a natural flow pattern of high winter and low summer-fall flows, typical of many Sacramento Valley streams that originate from foothills rather than the Cascade or Sierra crests. Near its mouth (where the gaging station is located) the stream is nearly dry during summer and fall months of low rainfall years. In wettest years, flows in winter months average 1,100 to 2,000 cfs. In winter months of dry years, average monthly flows reach only 30 to 70 cfs. In the driest years, winter monthly average flows reach only 20 to 35 cfs. Small agricultural diversions contribute to lower flows in summer and fall.



Bear Creek Streamflow, 1960-1967 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

Bear Creek is able to support populations of fall-run chinook salmon only when early fall rains create suitable conditions for passage over shallow riffles and allow access to the limited spawning habitat. Because of low and warm streamflow conditions in spring, juvenile salmon and steelhead must emigrate early in the season to survive.



Bear Creek Fall-run Chinook Salmon Returns, 1960-1999 (CDFG 1999).

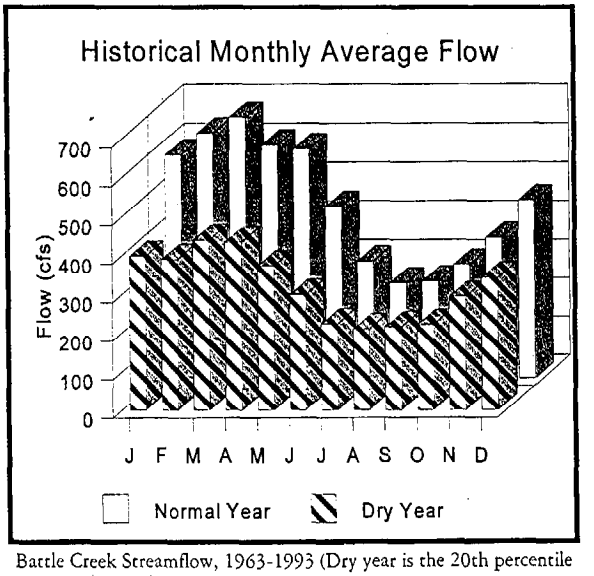
Salmon spawning surveys conducted during years with sufficient flows to attract adult salmon indicate that Bear Creek can support 150-300 spawning salmon. Steelhead have been observed in the creek, but no population estimates have been made.

Unscreened irrigation diversions operating during the juvenile emigration period for chinook salmon and steelhead can significantly reduce survival rates.

BATTLE CREEK ECOLOGICAL MANAGEMENT UNIT

Battle Creek enters the Sacramento River approximately 5 miles southeast of the Shasta County town of Cottonwood. It flows into the Sacramento Valley from the east, draining a watershed of approximately 360 square miles.

Battle Creek has a natural flow pattern of high winter and moderate summer-fall flows, typical of Mount Shasta-Cascade spring-fed streams. Near its mouth (where the gaging station is located), the stream has average flows of 240 to 260 cfs in summer and fall. Even in the drier years, flows are more than 150 cfs. In wettest years, flows in winter months average 1,200 to 2,400 cfs. Battle Creek has the best connection between the river and mountainous areas of any Sacramento River ecological management unit. PG&E operated a series of small run-of-the-river hydroelectric diversions that divert up to 98% of the



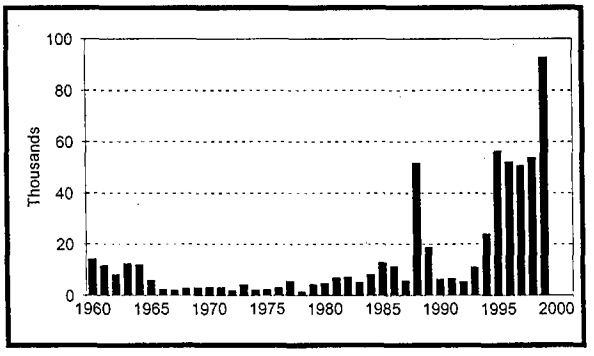
Battle Creek Streamflow, 1963-1993 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

stream's baseflow and a much smaller portion of the wet season flow. Under and interim agreement, the required minimum fishery releases to the creek are increased by a factor of 10 at three diversions in a 17-mile section of the creek system.

PG&E owns and operates the Battle Creek project, which consists of two small storage reservoirs, four unscreened hydropower diversions on the North Fork Battle Creek, three unscreened hydropower diversions on South Fork Battle Creek, a complex system of canals and forebays, and five powerhouses.

ERP proposes to restore important ecological functions and processes and habitats in a step-by-step approach over several years. Restoration of these ecosystem elements will permit the restoration of anadromous fish in the basin. In addition, restoration will require disease management measures for the fish hatchery water supply. As the range of anadromous fish in the watershed is increased, additional efforts will be directed at fish screens, fish ladders, hatchery water supply management, and increased releases of water from hydroelectric diversions. The approach will first restore the stream reach capable of supporting all types of anadromous fish. This approach will restore approximately one-half of the available anadromous fish habitat without subjecting the hatchery to increased disease risk or degrading the quality of the hatchery water supply.

Before development, Battle Creek was one of the most important chinook salmon spawning streams in the Sacramento Valley. Runs of fall-, winter-, and spring-run chinook salmon and steelhead were found there. Natural spawning of salmon and steelhead in Battle Creek between the Coleman National Fish Hatchery weir and the mouth is still significant but



Fall-run Chinook Salmon Returns to Battle Creek Below Coleman National Fish Hatchery, 1960-1999 (CDFG 1999).

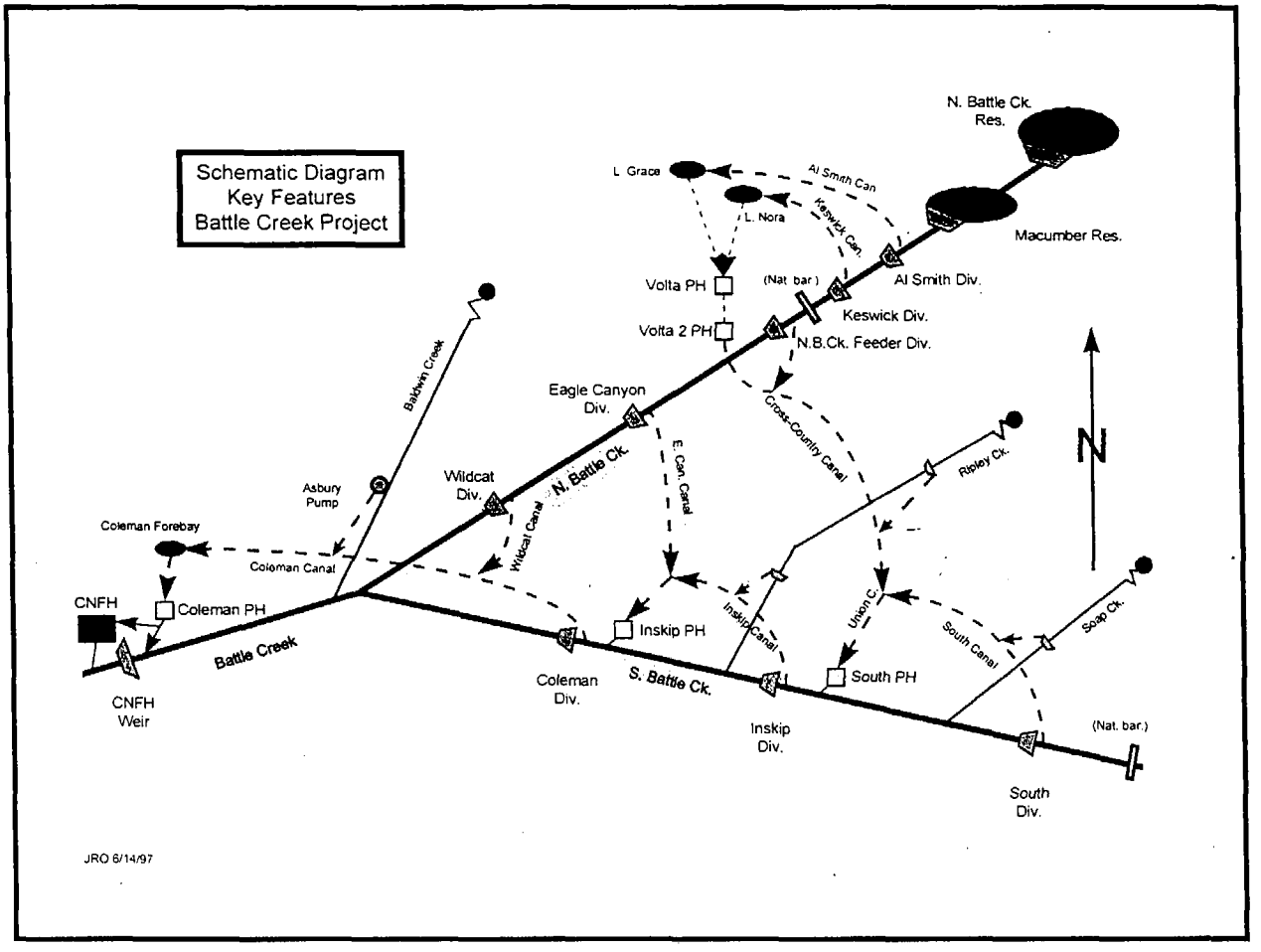
suffers from spawning populations too large for available habitat. The blockage of the fall-run chinook salmon migration at the hatchery and the effect of low flows caused by PG&E's hydropower operations have combined to reduce salmon and steelhead populations above the hatchery to remnant status.

There is one large, unscreened agricultural diversion (Battle Creek Diversion). DFG constructed a screen for this diversion, but because of landowner concerns, installation of the screen was delayed. The screen has recently been installed.

Restoring the remnant populations of naturally spawning chinook salmon and steelhead located above the fish hatchery barrier dam to a healthy status can be done in a manner that integrates the beneficial uses of hydropower production and aquaculture in the watershed. Physical and operational changes of PG&E's projects include screening or removing the diversions on the North Fork and South Fork of Battle Creek, increasing releases from project diversions, and stopping removal of stream gravel that accumulates at project diversions.

Anadromous fish have historically migrated above the hatchery during minor and major storm events each year which flood out the hatchery barrier dam and when the fish ladder at the barrier dam has been opened for four to five months during past years. The Coleman Hatchery Development Plan proposes a phased installation of an ozone sterilization system. The present level of ozonation at Coleman Hatchery (10,000 g.p.m.) is sufficient to sterilize all the water needed to produce the early life stages of chinook salmon and steelhead and one-third of the water necessary to produce juvenile fish. The environmental documents and preliminary funding arrangements have been completed to begin the construction of the remaining two-thirds of the water supply needed for juvenile fish production.

The restoration of naturally produced runs of anadromous fish in Battle Creek can be conducted in a manner compatible with the phasing in of the ozone treatment plant. If those races of salmon that represent a significant disease risk are restricted through seasonal fish ladder closures to the first 17-mile reach of Battle Creek above the hatchery for the initial phase of restoration, a hatchery water supply



can be maintained and the capacity to supply the balance of the hatchery water supply that will not be treated with ozone can be reached. It will be necessary to improve the reliability of the Coleman Canal water supply.

The fish hatchery, located approximately 6 miles upstream of the mouth of Battle Creek, is operated by the U.S. Fish and Wildlife Service (USFWS). It was constructed by Reclamation as partial mitigation for the construction of Shasta Dam and produces fall-run chinook salmon, late-fall-run chinook salmon, and steelhead trout. Winter-run chinook salmon, a federally and State-listed endangered species, was also successfully propagated in small numbers at the hatchery to supplement the wild population. The winter-run chinook artificial propagation program at Coleman was stopped and is in the process of being moved to a new facility at the base of Shasta Dam. This is scheduled to be operational in early 1998.

Restoration of Battle Creek's anadromous fish habitat above the valley floor will focus on restoring spring-run chinook salmon and steelhead trout. These actions will be sufficient to provide for the requirements of winter-run chinook salmon that may return to Battle Creek.

Surveys conducted before the construction of Shasta Dam indicate that, with sufficient water, the stream reaches above the fish hatchery could provide spawning habitat for more than 1,800 pairs of salmon. The stream reaches up to MacCumber Dam are not reachable by anadromous fish because of barriers. The anadromous reach in the North Fork Battle Creek extends up to approximately two miles above the North Fork Battle Feeder Dam. The recent (1991) evaluation of spawning habitat in the portions of Battle Creek watershed accessible to anadromous fish above Coleman Hatchery Fish Barrier estimate 166,000 square feet of spawning gravel. Potentially, this much spawning habitat could accommodate

3,500 spawning pair. The North Fork of Battle Creek, Eagle Canyon in particular, contains deep, cold, and isolated pools ideal for holding spring-run chinook salmon throughout summer. Because of the critically low numbers of spring-run chinook salmon and steelhead in the Sacramento River drainage, any expansion of available habitat for these fish has a high priority.

From 1985 through 1989, adult fall-run chinook salmon, surplus to the fish hatchery egg-taking needs, were released into Battle Creek above the hatchery weir to spawn naturally. Because of potential disease problems at the hatchery related to decomposing carcasses, the fish ladders on PG&E's two lowermost diversions (Wildcat Diversion on the North Fork and Coleman on the South Fork) were closed. This action prevented fish from ascending into the area above the hatchery water supply intake and eliminated the possibility of salmon migrating into the middle or upper reaches of those streams.

VISION FOR THE ECOLOGICAL MANAGEMENT ZONE

The vision for the North Sacramento Ecological Management Zone is to restore important fishery, wildlife, and plant communities to a healthy condition. To attain this vision, the Ecosystem Restoration Program Plan recommends developing and implementing comprehensive watershed management plans for the streams in this zone, which will restore important ecological processes that create and maintain habitats for fish, wildlife, and plant communities.

The vision focuses on restoring spring-run chinook salmon and steelhead to population levels of the late 1960s and early 1970s. To achieve this vision, ERP recommends increased protection for naturally produced chinook salmon and steelhead as they rear and migrate downstream from the natal areas to the mainstem Sacramento River. This would involve improving passage at water diversion structures; installing positive-barrier fish screens to protect juveniles; and providing sufficient flows for migration, holding, spawning, and rearing.

Gravel extraction is a significant problem in many areas of this ecological management zone, and a cooperative effort is needed to relocate this activity to sites away from the active stream channels. ERP also recommends reestablishing floodplains in the lower stream reaches to allow stream channel meander, sediment transport and deposition, and a healthy riparian corridor. Actions to maintain and restore healthy riparian zones include providing shaded riverine aquatic habitat and woody debris and maintaining biologically productive gravel beds for fish spawning and invertebrate production.

ERP envisions that the fish, wildlife, and riparian needs of the North Sacramento Valley Ecological Management Zone will be met and an acceptable level of ecosystem health will be achieved when the following visions have been satisfactorily attained.

VISIONS FOR ECOLOGICAL MANAGEMENT UNITS

CLEAR CREEK ECOLOGICAL MANAGEMENT UNIT

The vision for the Clear Creek Ecological Management Unit is to restore flows from Whiskeytown Dam to allow successful upstream passage of chinook salmon and steelhead to historical habitat, restore sediment transport and gravel recruitment in the stream channel, and establish a clearly defined stream meander zone, and riparian and riverine aquatic plant communities.

The potential of providing sustainable and resilient ecological processes and habitats will be enhanced by developing a locally sponsored watershed management planning process for this unit.

CLEAR CREEK WATERSHED DEMONSTRATION PROGRAM: Clear Creek has tentatively been selected as a demonstration watershed for the CALFED Stage 1 (first seven years) Implementation Program. During Stage 1, CALFED will support and bolster ongoing efforts to implement a successful management and rehabilitation effort within this watershed so that lessons learned in this watershed can be applied to similar watersheds.

Clear Creek has some interesting attributes that have contributed to its selection.

- The upper watershed is in mixed private and federal ownership and is included in the President's Northwest Forest Planning effort.

- The watershed is addressed by the Northwest Sacramento Province Advisory Committee comprised of representatives of federal agencies such as the U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management and others.
- Streamflows in Clear Creek below Whiskeytown Dam are controlled largely by the U.S. Bureau of Reclamation.
- Restoration of Clear Creek is specified in the Central Valley Project Improvement Act.
- Clear Creek supports chinook salmon and with restoration could support spring-run chinook salmon and steelhead.
- Strong local interest in the watershed.
- Many ongoing restoration activities and efforts such as land acquisition, water acquisition, and passage improvement.

Cumulatively, an investment in Clear Creek during Stage 1 will provide direct benefits to the creek and provide the types of restoration information needed to move the Ecosystem Restoration Program into subsequent implementation phases successfully. A few of the lessons to be learned in the Clear Creek watershed include how to improve overall watershed health; how to integrate local, state, federal, and private efforts in a large-scale restoration program; how to design and implement actions to benefit spring-run chinook salmon and steelhead; and how best to manage ecological processes such as sediment transport and stream meander in a highly modified stream system.

Cow Creek Ecological Management Unit

The vision for the Cow Creek Ecological Unit includes reducing adverse effects of timber harvest, erosion, and cattle grazing on the stream and riparian system and maintaining or restoring streamflows during important periods of the year to allow fish migration, spawning, and rearing of fall-run chinook salmon and steelhead trout. A comprehensive watershed management plan developed and implemented at the local level would assist in restoring this creek. In addition, sediment in the creek is limited, and ERP recommends a cooperative program to relocate gravel extraction operations to areas outside the active stream channel.

Actions on Cow Creek include obtaining flow agreements, screening diversions to protect all life stages of anadromous fish, improving fish passage at agricultural diversion structures, and fencing selected riparian corridors in the watershed to exclude livestock and promote riparian regeneration.

Bear Creek Ecological Management Unit

The vision for the Bear Creek Ecological Management Unit will emphasize restoring and maintaining important ecological processes, such as streamflow and sediment supply. Steelhead trout is an important species that will benefit from improvements related to fish passage and immigration and holding, spawning, and rearing habitats. The individual value of Bear Creek is small, but, cumulatively, the values of streams such as this can be integral and valuable in restoring ecological health to the Bay-Delta system, particularly for the steelhead trout and fall-run chinook salmon resources. Recent, but limited field studies, have shown that in some years lower Bear Creek can provide valuable non-natal rearing habitat for juvenile salmonids.

ERP recommends a cooperative program with water users for a mutually acceptable flow schedule that would not only provide protection for downstream migrating salmon and steelhead but recognize the needs of agriculture. This could be accomplished through conjunctive use of groundwater.

Battle Creek Ecological Management Unit

The vision for the Battle Creek Ecological Management Unit includes support for a local watershed conservancy and developing and implementing a comprehensive watershed management plan, increasing flows, improving the water supply to Coleman National Fish Hatchery, removing diversion dams or installing new ladders, and installing positive-barrier fish screens to protect juvenile chinook salmon and steelhead.

Improving water management operations and installing positive-barrier fish screens will provide large benefits to many aspects of the ecological

processes and fish and wildlife in the watershed. ERPP also envisions that Battle Creek will provide much-needed habitat for steelhead trout and spring-run chinook salmon, in addition to maintaining its existing importance to fall- and late-fall-run chinook.

VISIONS FOR ECOLOGICAL PROCESSES

CENTRAL VALLEY STREAMFLOW: Healthy instream flows are sustained to restore ecological processes and functions that maintain habitats and support aquatic species. Streamflows shape channels, support riparian vegetation, provide habitat for fish, and transport young fish downstream. Healthy streamflow patterns in the streams tributary to the upper reach of the Sacramento River below Keswick Dam would emulate natural flow patterns, with late-winter/ early-spring flow events and sustained flow well into the summer. The vision is that streamflow will be provided at levels that activate ecological processes that shape the stream channels and sustain riparian and riverine aquatic habitat, transport sediments, and sustain juvenile anadromous fish during the summer.

COARSE SEDIMENT SUPPLY: The supply of sediments to the streams in the North Sacramento Valley Ecological Management Zone support stream channel maintenance and sustain riparian and riverine aquatic habitats. This sediment includes gravel for fish spawning and invertebrate production The vision is that processes to provide a continual supply of coarse sediments will be restored, reactivated, or supplemented.

STREAM MEANDER: Streams in the North Sacramento Valley Ecological Management Zone exhibit a natural tendency to meander. This provides for the continual supply of coarse sediments, regeneration of the riparian corridor, and the rejuvenation of gravels used for fish spawning and invertebrate production. The vision is that stream meander corridors will be established or maintained to provide much of the needed sediments and habitats for fish, wildlife, and plant communities.

NATURAL FLOODPLAIN AND FLOOD PROCESSES: River-floodplain interactions are important ecological events that occur at varying intervals, ranging from annual inundation of some of the floodplain to flow or flood events that inundate most of the floodplain. The larger events occur within 5-, 10-, 50-year or longer intervals. This recurrent flood cycle maintains the stream channel, allows the stream to contact higher gravel terraces, supports riparian regeneration, and allows the stream channel to migrate. The vision is that the floodplains of streams in the North Sacramento Valley Ecological Management Zone will be maintained at levels that permit recurrent floodplain inundation.

CENTRAL VALLEY STREAM TEMPERATURES: Chinook salmon and steelhead are dependent on specific stream temperatures. Optimum spawning and egg incubation typically occurs at 52°F while optimum rearing temperatures are slightly higher. Temperature requirements also vary among chinook runs, species, and life stage. The vision for stream temperatures is to provide sufficient flows to sustain cool water during important life stages to support all life stages of chinook salmon, steelhead, and other aquatic organisms.

VISION FOR HABITATS

RIPARIAN AND RIVERINE AQUATIC: Riparian and riverine aquatic habitats support a wide diversity of aquatic and terrestrial species. Healthy riparian corridors provide a migratory pathway between lower and higher elevation habitats for terrestrial species, such as mammals and birds. Shaded riverine aquatic habitat provides important habitat complexity in the stream, which includes shade and escape cover for juvenile fish. The vision for riparian and riverine aquatic habitat is that riparian corridors will be maintain and restored by improvements in sediment transport, stream meander, reconnecting streams with their floodplains, improved grazing and other land use practices, and by the creation of extensive riparian protection zones.

FRESHWATER FISH HABITAT: Freshwater fish habitat is an important component needed to ensure the sustainability of resident native and anadromous fish species. The upper sections of these creeks are typical of salmon-steelhead streams while the lower sections are typical of fall chinook salmon spawning streams (Moyle and Ellison 1991). The vision is that the quality of freshwater fish habitat in these creeks will be maintained through actions directed at streamflows, coarse sediment supply, stream meander, natural floodplain and flood processes, and

maintaining and restoring riparian and riverine aquatic habitats.

ESSENTIAL FISH HABITAT: Clear, Cow, Bear, and Battle creeks have been identified as Essential Fish Habitat (EFH) based on the definition of waters currently or historically accessible to salmon (National Marine Fisheries Service 1998). The vision is for EFH is to maintain or restore substrate composition; water quality; water quantity, depth and velocity; channel gradient and stability; food; cover and habitat complexity; space; access and passage; and flood plain and habitat connectivity.

VISIONS FOR REDUCING OR ELIMINATING STRESSORS

WATER DIVERSION: Water diversions reduce the quantity of flow below the diversion point and cause direct mortality by entraining young fish. The vision for water diversion and unscreened diversion in the North Sacramento Valley Ecological Management Zone is that sufficient flow will remain below diversion points to permit the successful up- and downstream migration of adult and juvenile fish, and that water will be diverted through state-of-the-art positive barrier fish screens to reduce loss of juvenile fish.

DAMS AND OTHER STRUCTURES: Instream structures frequently impair the upstream and downstream passage of anadromous fish. The vision for the North Sacramento Valley Ecological Management Zone is that the connections between upstream holding, spawning, rearing, and migration habitats and the Sacramento River will be reestablished, improved, maintained, and reestablished on some - streams to permit unobstructed fish passage.

GRAVEL MINING: Gravel mining can greatly reduce the quality and quantity of coarse sediments in the streams of the North Sacramento Valley Ecological Management Zone. The vision is that gravel mining operations in the active stream channel will be reduced and relocated to alluvial deposits outside the active stream channel.

INVASIVE RIPARIAN AND MARSH PLANTS: Invasive riparian plants can outcompete and displace native vegetation. Often, these invasive plants have little or no value to native fish or wildlife species. The vision for reducing invasive riparian plants in the North Sacramento Valley Ecological Management Zone is to establish cooperative and coordinated eradication programs that allow the regeneration of native plant species and communities.

HARVEST OF FISH AND WILDLIFE: The legal and illegal harvest of chinook salmon and steelhead can reduce the number of spawning fish and impair other efforts to restore and rebuild spawning populations. The vision for illegal harvest in the North Sacramento Valley Ecological Management Zone is to implement a stronger enforcement and public education program. The vision for legal harvest is to develop harvest strategies that assist in the restoration of anadromous fish species.

ARTIFICIAL PROPAGATION OF FISH: The production of chinook salmon and steelhead at Coleman National Fish Hatchery on Battle Creek supports important sport and commercial fisheries and mitigates loss of salmon and steelhead habitat that resulted from the construction of Shasta Dam. Due to release practices, hatchery fish from Battle Creek and other Central Valley hatcheries supplement the numbers of naturally spawning salmon and steelhead in the Sacramento River and its tributaries. Hatchery salmon and steelhead may impede the recovery of wild populations by competing with wild stocks for resources. Hatchery-raised stocks, because of interbreeding, may not be genetically equivalent to wild stocks or may not have the instincts to survive in the wild. If these stocks breed with wild populations, overall genetic integrity suffers. The vision for artificial production in the North Sacramento Valley Ecological Management Zone is to implement hatchery practices that contribute to the recovery of naturally spawning populations of salmon and steelhead.

VISIONS FOR SPECIES

SPRING-RUN CHINOOK SALMON: The vision for spring-run chinook is to recover this State and federally listed threatened species, achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully use existing and restored habitats. Spring-run chinook are dependent on late-winter/early-spring flows for upstream passage, deep pools and cool water for oversummer survival, and quality gravel for successful spawning in the fall. The vision for spring-run chinook salmon in

the North Sacramento Valley Ecological Management Zone is that stream flows, stream temperatures, and habitat quality will be maintained or restored to a level that will support adult and juvenile populations.

WINTER-RUN CHINOOK SALMON: The vision for winter-run chinook salmon is to establish a self-sustaining population in Battle Creek to accelerate the recovery of this State and federally listed endangered species. The vision includes improved adult passage to upstream holding and spawning areas, high quality rearing of juvenile fish, limited interactions with hatchery produced fish, and no threat of disease contamination from the operation of Coleman National Fish Hatchery.

FALL-RUN CHINOOK SALMON: The vision for the fall-run chinook salmon is to recover all stocks. Fall-run chinook depend on late-summer and fall streamflow for access to spawning areas in the lower stream reaches. Habitat suitability is influenced by water temperatures. The vision for fall-run chinook salmon in the North Sacramento Valley Ecological Management Zone is that stream flows, stream temperatures, and habitat quality will be maintained or restored to a level that will support spawning and juvenile rearing through late spring.

LATE-FALL-RUN CHINOOK SALMON: The vision for late-fall-run chinook salmon is to recover this run which, along with fall-run chinook, is a candidate species under the ESA. Late-fall-run chinook typically depend on winter stream flows and quality spawning gravel. The vision for late-fall-run chinook salmon in the North Sacramento Valley Ecological Management Zone is to improve ecological processes that create and maintain spawning habitat and reduce sources of mortality that diminish survival of juvenile and adult fish.

STEELHEAD: The vision for Central Valley steelhead is to recover this federally listed threatened species and achieve naturally spawning populations of sufficient size to support inland recreational fishing at that use fully existing and restored habitats. Juvenile steelhead are dependent on cool water for oversummer survival, late-winter/early-spring flows for downstream passage, and quality gravel for successful spawning in the late winter/early spring. The vision for steelhead in the North Sacramento Valley Ecological Management Zone is that stream flows, stream temperatures, and habitat quality will be maintained or restored to a level that will support adult and juvenile populations.

LAMPREY: The vision for lamprey is to maintain and restore population distribution and abundance to higher levels than at present. The vision is also to understand life history better and identify factors in the North Sacramento Valley Ecological Management Zone which influence abundance. Lamprey are a California species of special concern. Because of limited information regarding their status, distribution, and abundance, the vision is that additional monitoring or research will provide the data necessary to manage these species and their habitat better.

NATIVE ANURAN AMPHIBIANS: The vision for the native anuran species is to stop habitat loss and the introduction of other species that prey on the different life stages of these amphibians. Ongoing surveys to monitor known populations and find additional populations is essential to gauge the health of the species in this group. To stabilize and increase anuran populations, non-native predator species should be eliminated from historic habitat ranges. Increasing suitable habitat and maintaining clean water supplies that meet the needs of the various species in this group is essential.

NATIVE RESIDENT FISH: The vision for native resident fish species is to maintain and restore by distribution and abundance of species such as Sacramento blackfish, hardhead, tule perch, Sacramento sucker, and California roach.

NEOTROPICAL MIGRATORY BIRDS: The vision for neotropical migratory birds is to maintain and increase populations through restoring habitats on which they depend.

PLANT SPECIES AND COMMUNITIES: The vision for plan species and communities is to protect and restore these resources in conjunction with efforts to protect and restore riparian and riverine aquatic habitats.

VALLEY ELDERBERRY LONGHORN BEETLE: The vision fr the valley elderberry longhorn beetle is to recover this federally listed threatened species by increasing its populations and abundance through restoration of riparian systems.